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**Nanodomain Swelling of Water-Equilibrated Block Copolymer Electrolyte Membranes**[1] CHELSEA CHEN, Dow Chemical Company, XI JIANG, NITASH BALSARA, Lawrence Berkeley National Lab — In this work, we examine the nanoscale swelling behavior of block copolymer electrolytes immersed in liquid water. A series of sulfonated polystyrene-*b*-polyethylene-*b*-polystyrene (S-SES) membranes having the same chemical composition but with different morphologies are prepared. We use small angle X-ray scattering (SAXS), cryogenic scanning transmission electron microscopy (cryo-STEM) and cryogenic electron tomography to characterize the nanodomain swelling of S-SES membranes. The relative increase of the nanodomain size upon hydration shows a transition which coincides with a morphological transition from lamellar to bicontinuous morphology. The nanodomain swelling of S-SES membranes with bicontinuous morphology is smaller than that of S-SES membranes with lamellar morphology while the water uptake is much larger. Electron tomography revealed that swelling of the membrane with bicontinuous morphology was spatially isotropic, which is the origin of the smaller relative domain size increase compared to the lamellar membranes whose swelling is anisotropic.

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